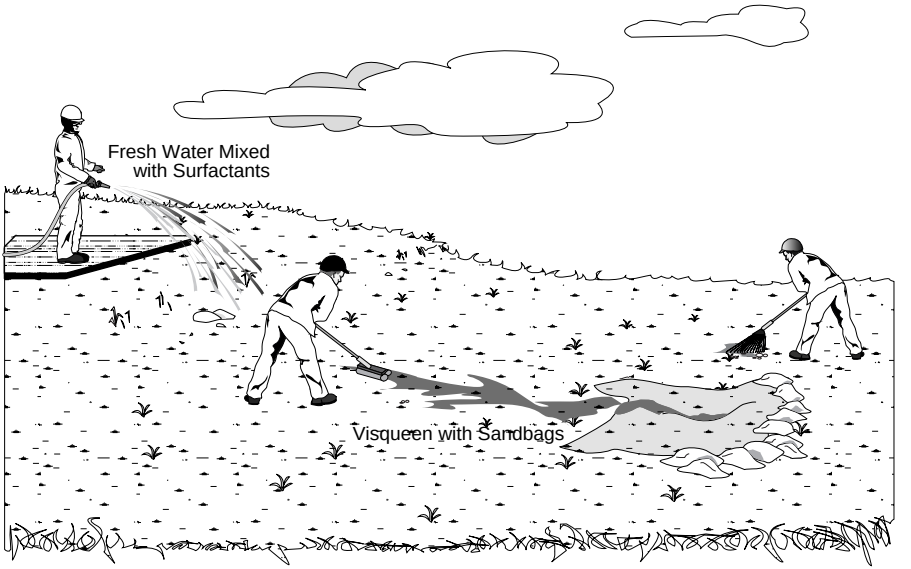
Flushing with Surfactants



Flushing with surfactants is essentially a wash-up tactic to be used after the majority of the spilled product has been removed using other methods. Surfactants can increase the ability of water to dissolve non-miscible products and can reduce adhesion of crude oil and fuels to vegetation. Flush with warm water (<106°F), if available, at high volume (50 to 250 gallons per minute) and low pressure (<50 pounds per square inch). The water source can be either a water truck, tank, or a tundra pond (do not use salt water). Flush toward a collection area, such as a natural depression or a trench (Tactic T-9) lined with Visqueen and shored with sandbags or Shore Seal boom (Tactic T-3). Workers may agitate the tundra surface while flushing by gently directing water flow with the discharge hose or by using a squeegee (Tactic T-12). Recover flush water by suction or pump (Tactic T-7) and dispose of properly.

The following are commercially available surfactants:

- Citrikleen
- Corexit
- Dawn detergent
- Eco/+
- Enviroglade
- NK-3
- SN-70

A surfactant is either added to the flush water or applied directly to the tundra at rates specified by the manufacturer. Dawn detergent was shown to remove the greatest amount of crude oil residue from tundra vegetation when used in bench-scale studies (Jorgenson and Cater, 1992). Corexit-treated tundra showed the greatest survival rates of wet tundra vegetation after one growing season (Jorgenson and Cater, 1992). Other commercial products may be available.

APPLICABILITY

	APPLICABILITY	COMMENTS
SPILLED SUBSTANCE	Non-water-miscible substances (oil, fuel)	• Recovery of substances miscible in water will not be enhanced by surfactants.
TUNDRA TYPE	All	• Not recommended for frozen tundra.
SEASON	Spring, summer, fall	• Flushing is a viable option only when air temperatures permit.

CONSIDERATIONS AND LIMITATIONS

- Always use low-pressure and warm or cold water for flushing. High-pressure (>250 gallons per minute), hot-water (>106°F) flushing can cause extensive physical damage to tundra vegetation (Alaska Clean Seas, 1999).
- Skimmers will not be effective after surfactants have been applied to the site.
- If Dawn detergent is to be used, batches without foaming agents should be requested from the manufacturer. Excessive foaming can cause problems in the field (Jorgenson and Cater, 1992).
- Do not use saltwater for flushing, as salt will further damage tundra soils.
- To minimize physical damage to vegetation, do not flush more than 2 or 3 times in one area.
- Stay off of area being flushed.
- This tactic has been adapted from Tactic R-4 in the *Alaska Clean Seas Technical Manual* (Alaska Clean Seas, 1999, Vol. 1) and has been used in treating crude-oil-affected moist and wet tundra on the North Slope with acceptable short-term results (Jorgenson and Cater, 1992; Cater and Jorgenson, 1999). Information on the effectiveness of this tactic is based on a bench-scale study (Jorgenson and Cater, 1992) and field observations. No test data exist which document whether the use of this tactic results in long-term benefits to tundra restoration compared with other tactics, combinations of tactics, or "no action."

EQUIPMENT, MATERIALS, AND PERSONNEL

- Water truck (2 operators per truck), tank, tundra pond – water source
- Surfactant – to dissolve spill residue
- Trash pump (2 operators per pump) – to pump water from source
- Suction hose (1 operator) – to take up water from water source
- Discharge hose (3- to 6-inch) with adjustable valve (1 operator) – to discharge water on site
- Mop, squeegee (1 operator) – to agitate and gently compress tundra mat to release spill residue
- Land barriers (Tactic T-3) (number of people needed is site-dependent) – to eliminate migration of flush-water off site; to provide collection point for flush water